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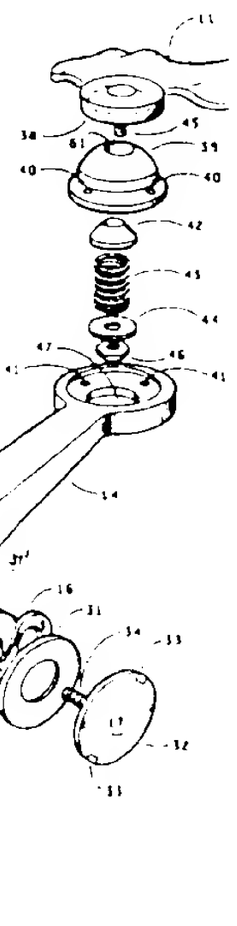
(54) Ergonomic equipment arm.

(57) A mounting arm is disclosed on one or free end of which a piece of electronic or other equipment (11) is mounted and the other end of which is detachably fastened to the edge of a desk or table (10) or other supporting structure. An arm member (14) has three moving joints that permit the equipment (11) fastened thereto to be moved with multiple degrees of freedom for desired positioning of the equipment. One joint utilizes a friction washer assembly (16, 31, 31') and a preloaded torsion spring (28) counterbalancing the weight of the equipment. The torsion spring (28) tension is adjustable to compensate for differing weight of equipment on the free end of the arm. Another joint utilizes a friction ball joint arrangement (15) having double concentric friction ball surfaces in an assembly that permits multiple degrees of freedom of motion and is easily removed from the remainder of the arm without disassembling the ball joint (15).



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ERGONOMIC EQUIPMENT ARM

The present invention relates to movable arms on which equipment is mounted and supported while being easily moved.

Movable arms on which equipment may be mounted are known in the art such as seen in U.S. Patent 3,030,128 issued April 17, 1962 to K. Versen. The movable arm shown in this patent utilizes three rotating and swivel joints in conjumction with friction couplings and a torsion spring to counter balance the weight of a lamp at the end of the arm. The interaction of all these joints and elements permits the lamp at the end of the movable arm to be easily positioned in a large number of positions within the reach of the arm, and the lamp will stay in the position in which it is placed.

There are, however, problems with such prior art movable arms. Each movable joint only has two degrees of freedom and when it is desired to orient the lamp or other equipment in a specific position there is often difficulty in that the three movable joints do not cooperatively move as easily as desired when the lamp or other equipment at the end of the arm is moved.

In addition, in some applications it is sometimes desired to change the type of equipment mounted on the end of the movable arm. In the prior art the weight of the new equipment must be the same as the weight of the

original equipment being replaced. If heavier or lighter equipment is placed on the end of the arm the counter balancing forces within the arm are not optimum for the new weight and the equipment sometimes will not stay in a position in which it is placed. For example, with a heavier piece of equipment the arm will sag when the equipment is manually positioned and then released. To compensate for this type of problem in the prior art the pressure on friction coupling elements in one or more of the movable joints is increased or decreased. However, when the pressure is increased it is correspondingly harder to position the heavier equipment on the end of the arm due to jerky arm movement with the result being difficulty in positioning the equipment in a precise position. This is caused by greater forces being required to overcome the increased friction and therefore increased tendency to overshoot. Thus, changing pressure on friction couplings accommodate for differing weight loads on the end of a movable arm is impractical. Accordingly, in the prior art a movable arm is usually only designed for a given weight load on the end of the arm. This has been acceptable in the prior art as there has not been much demand for movable arms that can accommodate differing weight loads.

In recent times there has developed a need for a movable arm that can accommodate differeing weight loads without experiencing the detrimental operation described in the last paragraph. For example, in the computer field including the word processing and office equipment fields in which television type video displays are used, some systems place the video display on a movable arm permitting the equipment user to place the display in whatever position they desire for greater ease in viewing the monitor. Movable arms have been designed for these applications. However, in different system configurations the displays are of different weights due to differing amounts of electronic equipment being in the

enclosure on the movable arm, due to larger or smaller cathode ray tubes being used for the display, and due to cathode ray tubes being from different manufacturers and thereby being of differing weights although they have the same size display areas. This has required that a number of different movable arms be utilized, or that the problems in the prior art be lived with. To create the different arm the torsion spring are typically changed. Often there is a comprise between these two solutions which lessens the problem but doesn't minimize or eliminate it. When a number of movable arms must be utilized there are increased costs for manufacturing and keeping records.

Thus, there is a need in the art for a movable arm that can be used with differing weight loads at the end of the arm without any change in the force required to move the load, and without requiring different parts.

There is also a need in the art for a movable arm that can be moved more easily than in the prior art.

The above described problems with prior art movable arms are solved by the novel movable arm, which is defined in the appended claims in its various aspects. The novel arm utilizes three movable joints two of which are pivoting joints each having two degrees of freedom and the third joint is a unique friction ball joint having more than two degrees of freedom which thereby allows the arm to be moved more easily. In addition, means are provided for quickly and easily adusting the tension of a torsion spring within one of the joints of our arm to properly counterbalance differing weights on the end of the arm. This permits different weights on the end of the movable arm to all be moved with equal

ease. Furthermore, a clamp is provided on the end of our movable arm opposite the free end on which the equipment is fastened which permits the movable arm to be mounted on other than a dedicated support base table. This permits greater flexibility and portability. For example, with a small computer system or word processor terminal the video display can be mounted on the edge of an existing desk or table.

The invention will be better understood on reading the following detailed description in conjunction with the drawing in which:

Figure 1 shows the assembled attached to the top of a table and flexibly supporting a television type monitor;

Figure 2 is an exploded assembly drawing showing the individual elements making up the novel arm;

Figure 3 is a bottom view of the base of the arm to show the manner in which it controls the maximum swing of the arm;

Figure 4 is a side view of the base of the arm showing the torsion spring adjustment; and

Figure 5 is a cross section view of the assembled friction ball joint at the end of the arm supporting a piece of equipment such as a video display.

In Figure 1 is shown an assembled arm in accordance with the teaching of the invention. The novel arm is quickly and easily mounted to table 10 which is shown in phantom view by means of a clamp 12. The other end of our arm is fastened to a piece of equipment 11 also shown in phantom view and, which for the present application is a video display. The arm is made up of clamp 12 which is used to fasten our arm to the edge of a desk or table 10 or to any other mounting structure having an edge to which the clamp can be fastened. A base 13 is connected to clamp 12 such that base 13 can rotate in a plane parallel to the surface of table 10. Base 13 is connected to an arm member 14 via an adjustable torsion spring [not shown] and a friction coupling [not shown], and arm member 14 can rotate in a plane perpendicular to the plane of the top of table 10. At the outer end of arm member 14 is connected a friction ball joint assembly 15 which is in turn fastened to the base of video display 11. Friction ball joint assembly 15 enables video display 11 to be tilted forward and backward and from side to side. With friction ball joint assembly 15 video display 11 may be moved to any position and it will remain in that position without tilting further due to its own weight. Thus, the combination of the different joints in the movable arm coupled with an adjustable torsion spring and friction coupling provide for multiple degrees of freedom of movement of our novel movable arm and video display 11.

In Figure 2 is shown an exploded view of the novel movable arm showing the individual components making up the arm. Clamp 12 is partially C shaped as shown to go around the edge of a desk, table or any other mounting surface, whether that mounting surface be horizontal or other than horizontal. Screw means 20 is used to move plate 21 in a

vertical direction to securely fasten clamp 12 onto the edge of a table in a manner well known in the art. The top of plate 21 and its opposing surface on clamp 12 may have a piece of plastic or other material fastened thereto to provide friction in contact with the mounting surface and to prevent marring the mounting surface. Plate 21 has two conical protruberations 21' and 21" which may be created with conical set screws in threaded holes. These protruberations 21' and 21" imbed in the underside of table 10 so the clamp will not slip. The top surface of clamp 12 has a circular recess 22 having a diameter only slightly larger than circular bottom 26 of base 13. Within recess 22 are located three holes 24 in only one of which is placed a peg 25. The particular one of holes 24 in which peg 25 is placed determines the rotational travel of base 13 on the top of clamp 12 as will be better understood in the description for Figure 3 further in this specification. Holes 24 may also be threaded and a set screw turned partially therein to accomplish the same result as peg 25.

Recess 22 in clamp 12 also has a pivot member 23 mounted thereon which has a groove 19 around its periphery as shown. Groove 19 is used to fasten base 13 to clamp 12 as is described hereinafter. Base 13 has a hole 18 vertically therethrough having substantially the same diameter as pivot member 23. Hole 18 may also be oversized with a brass bushing press fit therein with the inside diameter of the bushing being substantially the same diameter as pivot member 23. Base 13 is mounted down on clamp 12 with its bottom portion 26 sitting within recess 22 of clamp 12 and with pivot member 23 coming up through hole 18 of base 13. When in this position a recessed screw [not shown] is turned inward in threaded hole 30 through base 13 until the tip of the screw extends into groove 19 around pivot member 23. There is not an interference fit between the screw and pivot member 23. A drop of thread lock sealant may be added to the thread

of a screw to retain it in hole 30 without loosening. With the screw mounted in hole 30 as just described, base 13 cannot be removed from clamp 12 but can rotate about pivot member 23. A nyler piece [not shown] may be placed in recess 22 before base 13 is assembled to clamp 12 to aid in movement of base 13.

Base 13 also has a pivot member 27 which is coaxial with and mounts within hole 36 through arm member 14 when arm member 14 is assembled to base 13. The diameter of hole 36 and pivot member 27 are substantially the same. Again, a brass bushing may be used in hole 36. In assembly torsion spring 28 is partially wound to provide tension, is mounted over the outside of pivot member 27 and arm member 14 is then mounted up against base 13 on pivot member 27. When arm member 14 is mounted up against base 13, wound torsion spring 28 is captivated between these two members. Hook end 49 of torsion spring 28 is captivated by a boss [not shown] within the back side of arm member 14. Hook end 48 of torsion spring 28 crosses the axis of threaded hole 29 through base 13 and is captivated by a boss 53 [not shown in Fig. 2, but shown in Fig. 4] on base 13 to prevent torsion spring 28 from unwinding. A recessed screw 54 [not shown in Fig. 2, but shown in Fig. 4] within threaded hole 29 has the tip of the screw hitting hook end 48 of torsion spring 28. As the screw [not shown] is screwed further within hole 29 it pushes against hook end 48 of spring 28 to increase the torsion loading of spring 28 and thereby provides an effectual means to adjust the torsion loading of spring 28 to compensate for different weight loads attached to the outer end of arm member 14 via friction ball joint assembly 15. Initially, screw 54 in hole 29 is set to push hook end 48 away from lip 53 [shown in Fig. 4] and thereafter the torsion of spring 28 may be increased or decreased by turning screw 54.

Arm member 14 is held assembled to base 13 in the following manner. A friction screw 17 has a broad head 32 and a threaded shaft 34 which passes through friction washer 31, wave washer 16, cork washer31' and then through hole 36 at the bottom end of arm member 14. Threaded shaft 34 then passes through torsion spring 28 and into threaded hole 35 in the end of pivot member 27 on base 13. Head 32 of friction screw 17 has a diameter only slightly smaller than the diameter of a recess 37 in the bottom end of arm member 14. On assembly the screw captivates washers 16, 31 and 31' within recess 37 and fastens arm member 14 onto base 13. Head 32 of friction screw 17 has two edge recesses 33 and a spanner wrench is utilized to tighten screw 17. As screw 17 is tightened against washers 16, 31 and 31' friction is created against the movement of arm member 14 about pivot member 27 due to the function of the washers. The outer end of arm member 14 has a hole 47 therethrough and a plurality of mounting holes 41 as shown. On assembly, screws coming up through threaded holes 41 from the bottom of arm member 14 will be turned into respective ones of threaded holes 40 through the flange of middle friction member 39 of our novel friction ball joint 15. This is shown in greater detail in Figure 5. In this manner middle friction member 39 is attached to the outer end of arm member 14. The rest of our novel friction ball joint 15 comprises an upper friction member 38, a fastening screw 45, a lower friction member 42, a spring 43, a flat washer 44, and a nut 46. The diameter of hole 47 through the outer end of arm member 14 is greater than the diameter of lower friction member 42, spring 43, flat washer 44, and nut 46. The holes through upper friction member 38 and lower friction member 42 each have a diameter only slightly larger than the diameter of the shaft of screw 45. However, the hole 61 through middle friction member 39 is significantly larger than the diamater of the threaded shaft of screw 45. The concave bottom of upper friction member 38 is spherical and has the

same radius and center point of curvature as the convex spherical top of middle friction member 39. The concave bottom side of middle friction member 39 is also spherical, has a radius of curvature equal to that of the convex spherical top of lower friction member 42 and has a common center point of radius as all the spherical surfaces. On final assembly the spherical top of lower friction member 42 is mounted up inside the spherical surface in the bottom of middle friction member 39 and the spherical top surface of member 39 is mounted up inside the spherical surface in the bottom of upper friction member 38 such that all spherical surfaces are free to move about the common center point. On assembly nut 46 is screwed onto the threaded end of screw 45 and is screwed down to apply pressure via washer 44 and spring 43 to hold members 38, 39 and 42 against each other as is shown in greater detail in Figure 5. Depending upon how tight bolt 45 is screwed on to the shaft of screw 46 the degree of friction created between the spherical mating surfaces of elements 38, 39 and 42 may be varied to create our novel double surface friction ball joint 15. Upper friction member 39 is attached to video display 11 or may be an integral part of the base of video display 11. As video display 11 is tilted forward, backward or to either side elements 38, 45, 42, 43, 44, and 46 pivot about while member 39 remains in a fixed position attached to outer end of arm member 14. The friction between the assembled elements 38, 39 and 42 permit the video display 11 to be moved into a position and remain in that position.

Turning now to Figure 3 therein is shown a bottom view of base 13. In the bottom of base 13 are located three grooves 50, 51, 52 which lie along the periphery of circles having different radii. When base 13 is assembled to clamp 12 each of grooves 50, 51 and 52 sits directly over one of the three holes 24 in recess 22. As previously mentioned, peg 25 is

inserted into one of holes 24 and extends upward out of the hole as shown in Figure 2. The portion of peg 25 protruding up from a hole 24 extends into one of grooves 50, 51 and 52. In particular, when peg 25 is located in the one of holes 24 closest to pivot member 23 of clamp 12, the top of peg 25 protrudes into groove 52. Rotation of base 13 is thereby limited to ninety degrees in one quadrant. When peg 25 is mounted in the middle one of holes 24 of base 13 its protruding end extends into groove 51 to restrict rotation to 90 degrees in a different quadrant. With peg 25 being located in the outer one of the three holes 24 it extends into groove 50 which allows for 180 degrees rotation of base 13 about pivot member 23 of clamp 12. It would be obvious to one skilled in the art that the position and length of these grooves may be varied to suit particular applications or may be eliminated allowing a full 360 degrees rotation.

Figure 4 is a side view of base 13 showing the aforementioned lip or boss 53 against which hook end 48 of partially wound torsion spring 28 sits when spring 28 is assembled between base 13 and arm member 14 on assembly of the arm. Hook end 48 extends downward and is in line with the axis of hole 29 through base 13 and screw 54 therein the tip of which contacts hook end 48. The tension of torsion spring 28 is increased by turning screw 54 into threaded hole 29 through base 13. Screw 54 is screwed in to push hook end 48 of spring 28 away from lip 53 to set an initial tension in torsion spring 28. As different weight loads are attached to the outer end of the novel arm, screw 54 is screwed in or out to change the tension of torsion spring 28 to compensate for the different weight load. For lighter weight loads on the end of the novel arm screw 54 is unscrewed to decrease the tension of torsion spring 28. For heavier weights on the end of the arm, screw 54 is screwed into hole 29 to further wind tension spring 28 and thereby increase the torsion to compensate for the increased weight load.

Figure 5 shows the above described details of the novel friction ball joint 15 with the ball joint being in an assembled state. The outer end of arm member 14 having hole 47 therethrough is only partially shown with its mounting holes 41 being aligned with the holes 40 through the flange of middle friction member 39 and which is fastened to arm member 14 via screws through each pair of holes 40 and 41. Thus, member 39 is affixed to arm member 14. Upper friction member 38 is an integral part of or is attached to video display 11 [not shown]. It can be seen how the spherical inner surface of upper friction member 38 matches the convex spherical surface of middle friction member 39. It can also be seen how the concave spherical surface of member 39 mates with the convex spherical surface of lower friction member 42 and all spherical surfaces have a common center point of radii. In assembly nut 46 is fastened to bolt 45 as shown and applies pressure via washer 44 and spring 43 against lower friction member 42. This spring action forces members 38, 39 and 42 together so that there is a friction coupling as well as a ball joint function being accomplished between members 38, 39 and 42 as shown in Figure 5. As video display 11 [not shown in Figure 5] is tilted forward, backward or from side to side the ball joint friction members 38, 39 and 42 rotate against each other with a friction coupling. This friction coupling permits the video display 11 to be tilted to a certain position and then to stay in that position. The degree of friction coupling in our novel friction ball joint depends upon the nature of the materials and the amount of force transmitted through spring 43 to elements 38, 39 and 42 when turning nut 46 onto bolt 45.

While what has been described above is the preferred embodiment of the invention, it would be obvious to those skilled in the art that numerous variations may be made therein without departing from the spirit

and scope of the invention. For instance hole 61 through middle friction member 39 may be oval or any oher shape and limit the degree to which video display 11 [not shown in Figure 5] may be tilted. In addition, spring 43 in the friction ball joint 15 may be eliminated and pressure applied directly by nut 46. Further, it should be realized that friction ball joint 15 may be modified to eliminate one of the spherical friction surfaces.

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Claims:

1. An ergonomic movable equipment arm having multiple degrees of freedom, on one end, the free end, of which is mounted equipment (11), in particular such as a video display or monitor in a computer system, and the other end of which is attachable to a support structure (10), in particular to a desk or table, said arm comprising

means (12) for detachably mounting the movable arm to the support structure (10),

a base (13) pivotally fastened to the mounting means (12),

an arm member (14) pivotally fastened to the base (13),

a helical spring (28) having a first and a second hook end (48, 49) mounted between the base (13) and the arm member (14) and functioning as a torsion spring to counterbalance the weight of the equipment (11) on the free end of the arm member (14), the second hook end (49) being held in a fixed position against the base (13),

means for providing a friction coupling between the base (13) and the arm member (14) and

a friction joint connected to the free end of the arm to which said equipment (11) is attached,

characterized by

adjustment means (54) operatively attached to the mounting means (12) and engaging the first hook end (48), the adjustment means (54) being operable to either wind the helical spring (28) to increase tension and thereby compensate for heavier equipment on the end of the arm member (14), or to unwind the helical spring (28) to decrease tension and thereby compensate for lighter equipment on the free end of the arms, and

a friction ball joint (15) connected to the free end of the arm member (14) allowing the equipment to be tilted in any direction with respect to the arm member (14) and remain in the position in which it is placed.

2. The arm in accordance with claim 1

characterized in that

said friction ball joint (15) comprises

a first friction ball joint member (38) having a first concave spherical surface,

a second friction ball joint member (39) having a first convex spherical surface with a radius of curvature equal to that of the first concave spherical surface with which it mates when the friction ball joint is assembled, and

means for fastening (43, 44, 45, 46) the first and the second friction ball joint members (38, 39) together with their spherical surfaces mating, the fastening means forcing the two members together to create a friction coupling therebetween so that as one of said two members is moved with respect to the other they will remain in the position they are moved to, despite a force being applied to one of them due to the weight of the equipment.

3. The arm in accordance with claim 2

characterized in that

the second friction ball joint member (39) is fastened to the free end of the arm member (14) and has a second concave spherical surface, the first friction ball joint member (38) is attached to said equipment (11), and

that the friction ball joint (15) further comprises

a third friction ball joint member (42) having a second convex spherical surface with a radius of curvature equal to that of the second concave spherical surface with which it mates when the friction ball joint is assembled, the fastening means (43, 44, 45, 46) fastening the first, second and third friction ball joint members (38, 39, 42) together with their spherical surfaces mating to create said friction coupling therebetween so that as the equipment (11) is tilted in any direction the first and third friction ball joint members (38, 42) move in unison against the second member (39) and the equipment (11) remains in the position in which it is placed.

4. The arm in accordance with claim 3

characterized in that

each of the first, second and third friction ball joint members (38, 39, 42) have an aperture (61) through their spherical surfaces with the apertures through the first and third members (38, 42) being of a first diameter and the aperture (61) through the second member (39) being larger than the first diameter, and

that said fastening means comprises

a bolt (45) passing through the apertures of the first, second and third members (38, 39, 42), and

a nut (46) on the end of the bolt (45), the nut being turned onto the bolt to apply a force to the first, second and third member (38, 39, 42) to create said friction coupling therebetween.

5. The arm in accordance with any of claims 1 to 4,

characterized in that

said friction coupling means comprises

a friction screw (17) having a wide head (32) and a screw shaft (34) which passes through the one end of the arm member (14) and screws into the base (13) to hold the arm member to the base and

at least one friction washer (16, 31, 31') between the head (32) of the friction screw (17) and the arm member (14), the friction washer creating friction against the movement of the

arm member (14) , the friction washer cooperating with the helical spring (28) to allow said equipment (11) on the free end of the arm member (14) to be moved to some position and remain in that position, the amount of friction being dependent upon the position of the friction screw (17).

6. The arm in accordance with any of claims 1 to 5

characterized in that

the mounting means (12) has a plurality of holes (24) located on the surface thereof against which the base (13) is mounted, the base (13) has a plurality of circular grooves (50, 51, 52) of defined arcuate length on the side thereof that is in contact with the mounting means (12), with the radius of the circles on the circumference of which the grooves are located being of different radii, and at least one of the grooves being located over each one of the holes in the mounting means when the base (13) is rotatably fastened to said mounting means (12), and a peg (25) is placed in one of the holes (24) prior to assembling the base (13) to the mounting means and the peg rides in the groove associated with the hole without interfrence when the base (13) is fastened to the mounting means, the peg (25) functioning to limit the travel of the base (13) as it rotates on the mounting means.

7. The arm in accordance with any of claims 1 and 6

characterized in that

the mounting means comprises an adjustable clamp (12) having two jaws, one jaw gripping either side of the support structure (10) to attach the arm member (14) to the surface, one of the jaws (21) having at least one protruberation (21, 21') therefrom to engage the support structure to prevent the arm from being loosened from the support structure.

8. The arm in accordance with any of claim 5 to 7

characterized in that

said friction coupling means comprises

a friction screw (17) having a wide head (32) and a screw shaft (34) which passed through the one end of the arm member (14) and screws into the base (13) to hold the arm member (14) to the base (13), and

at least one friction washer (16, 31, 31') between the head (32) of the friction screw (17) and the arm member (14), the friction washer creating friction against the movement of the arm member, the friction washer cooperating with the helical spring (28) to allow the equipment (11) on the free end of the arm member (14) to be moved to some position and remain in that position, and the amount of friction being dependent upon how much the friction screw is screwed in.

9. The arm in accordance with any of claims 5 to 8

characterized in that

said friction washers comprise a plastic washer (31) and a cork washer (31') on either side of a wave washer (16).

10. A swivel joint for an arm movable with multiple degrees of freedom, on one end, the free end, of which is mounted equipment (11), such as a video display or a monitor in a computer system, and the other end of which is attachable to a support structure (10), the swivel joint (13) including a rotating joint having a first and a second swivel member fastened together by a fastening means (17, 35) so that they may rotate with respect to each other, and a helical spring (28) having a first and a second hook end (48, 49) mounted between the

swivel members and functioning as a torsion spring to counter-balance the weight of the equipment (11),

characterized by

adjustment means (54) associated with the first swivel member and engaging the first hook end (48) while the second hook end (49) is held in a fixed position against the second swivel member, the adjustment means being operable to either wind the helical spring (28) to increase tension and thereby compensate for heavier equipment or to unwind the helical spring to decrease tension and thereby compensate for lighter equipment on the end of the arm.

11. The swivel joint in accordance with claim 10

characterized in that

the adjustment means comprises a screw (54) mounted in a threaded hole (30) through the first swivel member with one end of the screw (54) touching the first hook end (48) and as the screw means is turned in one direction it applies pressure against the first hook end and winds said helical spring (28) to increase tension and as said screw (54) is turned in the opposite direction it removes pressure from the first hook end (48) to unwind the helical spring and decrease tension.

12. A swivel joint for an arm movable with multiple degrees of freedom, on one end of which is mounted equipment (11), such as a video display or a monitor in a computer system, and the other end of the arm is attachable to a support structure (10), in particular for an arm in accordance with claim 1 or 2

characterized by

a first friction ball joint member (38) having a first concave spherical surface,

a second friction ball joint member (39) having a first convex shperical surface with a radius of curvature equal to that of the first concave spherical surface with which it mates when said friction ball joint is assembled, and

means for fastening (43, 44, 45, 46) the first and the second friction ball joint members (38, 39) together with their spherical surfaces mating, the fastening means forcing the two members (38, 39) together to create a friction coupling therebetween so that as one of the two members is moved with respect to the other they will remain in the position they are moved to, despite a force being applied to one of said two members due to the weight of said equipment on the end of the arm.

13. The swivel joint in accordance with claim 12

characterized in that

the second friction ball joint member (39) is fastened to the free end of said arm member (14) and has a second concave spherical surface, the first friction ball joint member (38) is attached to the equipment (11), and

the friction ball joint (15) further comprises

a third friction ball joint member (42) having a second convex spherical surface with a radius of curvature substantially equal to that of the second concave spherical surface with which it mates when the friction ball joint is assembled, said fastening means (43, 44, 45, 46) fastening the first, second

and third friction ball joint members (38, 39, 42) together with their spherical surfaces mating to create said friction coupling therebetween so that as the equipment (11) is tilted in any direction the first and third friction ball joint members (38, 42) move in unison against the second member (339) and the equipment (11) remains in the position in which it is placed.

14. The swivel joint in accordance with claim 13

characterized in that

each of the first, second and third friction ball joint members (38, 39, 42) have an aperture (61) through their spherical surfaces with the apertures through said first and third members (38, 42) being of a first diameter and the aperture (61) through the second member (39) being larger than the first diameter, and

the fastening means comprises

a bolt (45) passing through the appertures of the first, second and third member (38, 39, 42) and

a nut (46) on the end of the bolt (45) the nut being turned onto the bolt to apply a force to the first, second and third members (38, 39, 42) to create the friction coupling therebetween.

15. In a computer system, a movable equipment arm having multiple degrees of freedom, on one end, the free end, of which is mounted equipment (11), in particular such as a video display (monitor) in a computer system, and the other end of which is attachable to a support structure (10), in particular to a desk or table, said arm comprising

means (12) for detachably mounting the movable arm to the support structure (10),

a base (13) pivotally fastened to the mounting means (12),

an arm member pivotally fastened to the base (13),

a helical spring (28) having a first and a second hook end (48, 49) mounted between the base (13) and the arm member (14) and functioning as a torsion spring to counterbalance the weight of the equipment (11) on the free end of the arm member (14), the second hook end (49) being held in a fixed position against the base (13),

means for providing a friction coupling between the base (13) and the arm member (14) and

a friction joint connected to the free end of the arm to which said equipment (11) is attached,

characterized by

adjustment means (54) operatively attached to the mounting means (12) and engaging the first hook end (48), the adjustment means (54) being operable to either wind the helical spring (28) to increase tension and thereby compensate for heavier equipment on the end of the arm member (14), or to unwind the helical spring (28) to decrease tension and thereby compensate for lighter equipment on the free end of the arms, and

a friction ball joint (15) connected to the free end of the arm member (14) allowing the equipment to be tilted in any direction with respect to the arm member (14) and remain in the position in which it is placed.

16. The arm in accordance with claim 15

characterized in that

said friction ball joint (15) comprises

a first friction ball joint member (38) having a first concave spherical surface,

a second friction ball joint member (39) having a first convex spherical surface with a radius of curvature equal to that of the first concave spherical surface with which it mates when the friction ball joint is assembled, and

means for fastening (43, 44, 45, 46) the first and the second friction ball joint members (38, 39) together with their spherical surfaces mating, the fastening means forcing the two members together to create a friction coupling therebetween so that as one of said two members is moved with respect to the other they will remain in the position they are moved to, despite a force being applied to one of them due to the weight of the equipment.

17. The arm in accordance with claim 16

characterized in that

said second friction ball joint member (39) has a second concave spherical surface and that the friction ball joint (15) further comprises

a third friction ball joint member (42) having a second convex spherical surface with a radius of curvature substantially equal to that of the second concave spherical surface with which it mates when the friction ball joint is assembled, the

fastening means (43, 44, 45, 46) forcing the two members together to create a friction coupling therebetween so that as one of the two members is moved with respect to the other of the members by moving the equipment (11) the equipment will remain in the position it is placed in despite of its weight.

18. A data entry and display terminal comprising

a monitor for displaying information represented in the display terminal by digital data,

a keyboard for generating digital data for creating the information displayed on the display terminal,

means for eletrically connecting the keyboard means and the display terminal, and

a movable arm connected to and supporting the display terminal, on one end, the free end, thereof for viewing said terminal at multiple positions of orientation,

characterized by

means (12) on the other end of the arm used by the operator of the data entry and display terminal detachably mounting the other end of the arm to a support structure (10).

19. The terminal in accordance with claim 18

characterized in that

said arm member (14) further comprises

a swivel joint connected to the mounting means (12), and

23. The terminal in accordance with claim 22

characterized in that

the second frictional ball joint member (39) is fastened to the free end of the arm member (14) and has a second concave spherical surface, said first friction ball joint member (38) is attached to said display terminal (11), and

the friction ball joint (15) further comprises

a third friction ball joint member (42) having a second convex spherical surface with a radius of curvature equal to that of the second concave spherical surface with which it mates when the friction ball joint is assembled,

the fastening means (43, 44, 45, 46) fastening the first, second and third friction ball joint members (38, 39, 42) together with their spherical surfaces mating to create the friction coupling therebetween so that as the display terminal (11) is tilted in any direction, the first and third friction ball joint members (38, 42) move in unison against the second member (38) and the display terminal (11) remains in the position in which it is placed.

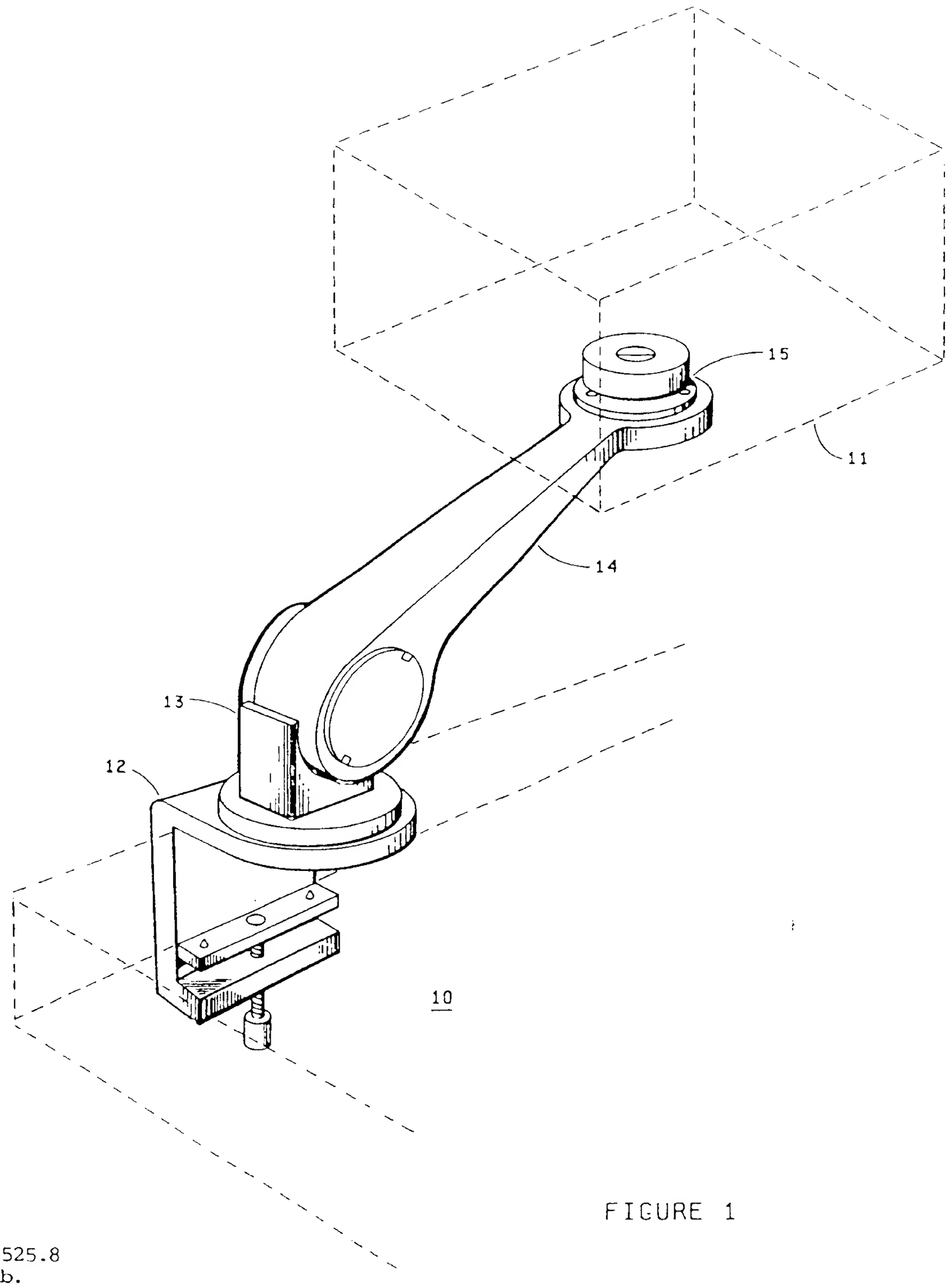

FIGURE 1

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Wang Lab.
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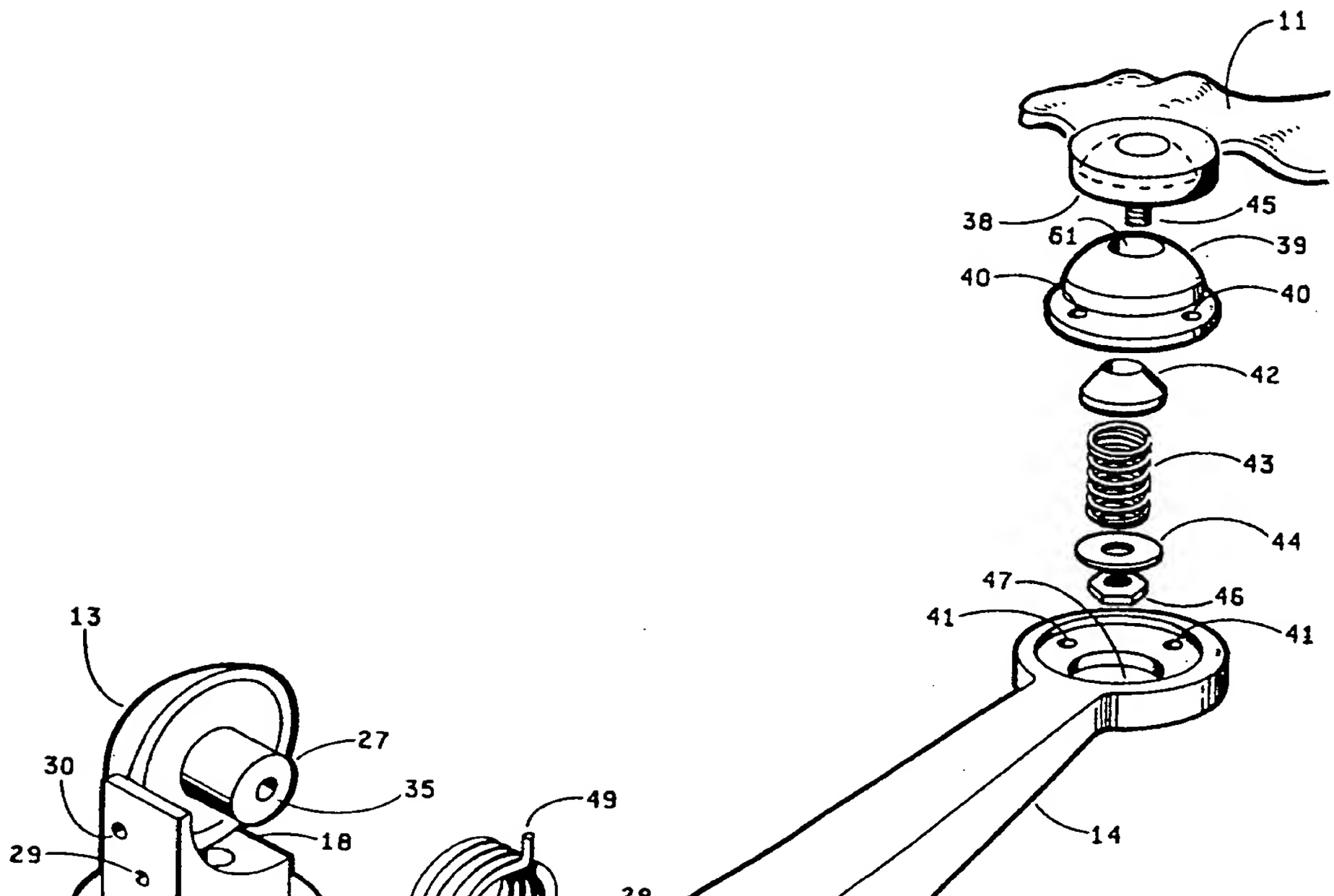
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FIGURE 2

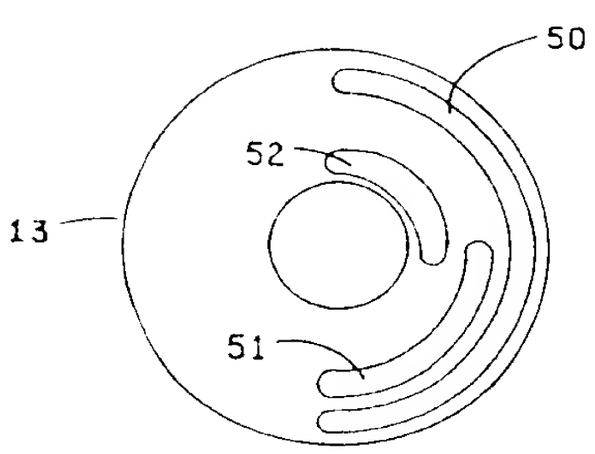

FIGURE 3

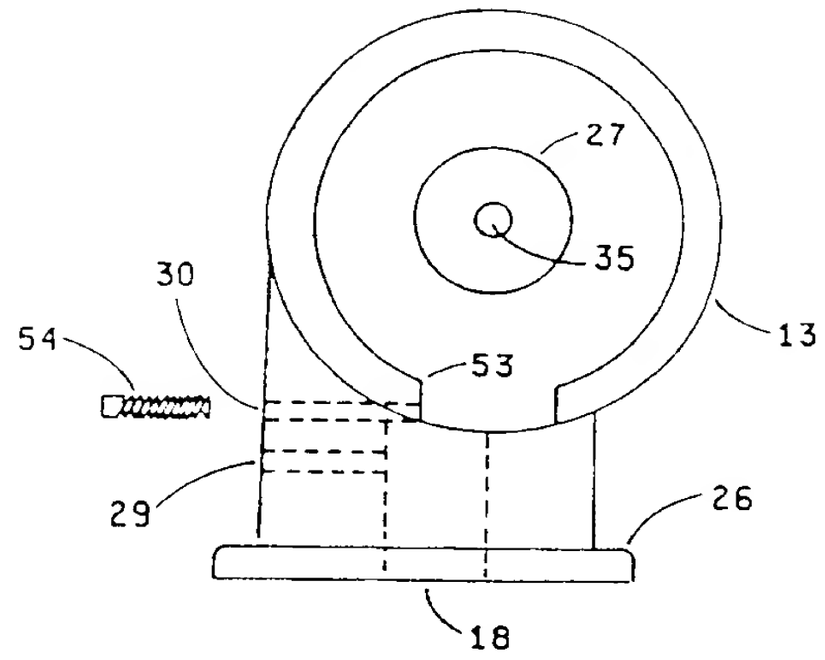

FIGURE 4

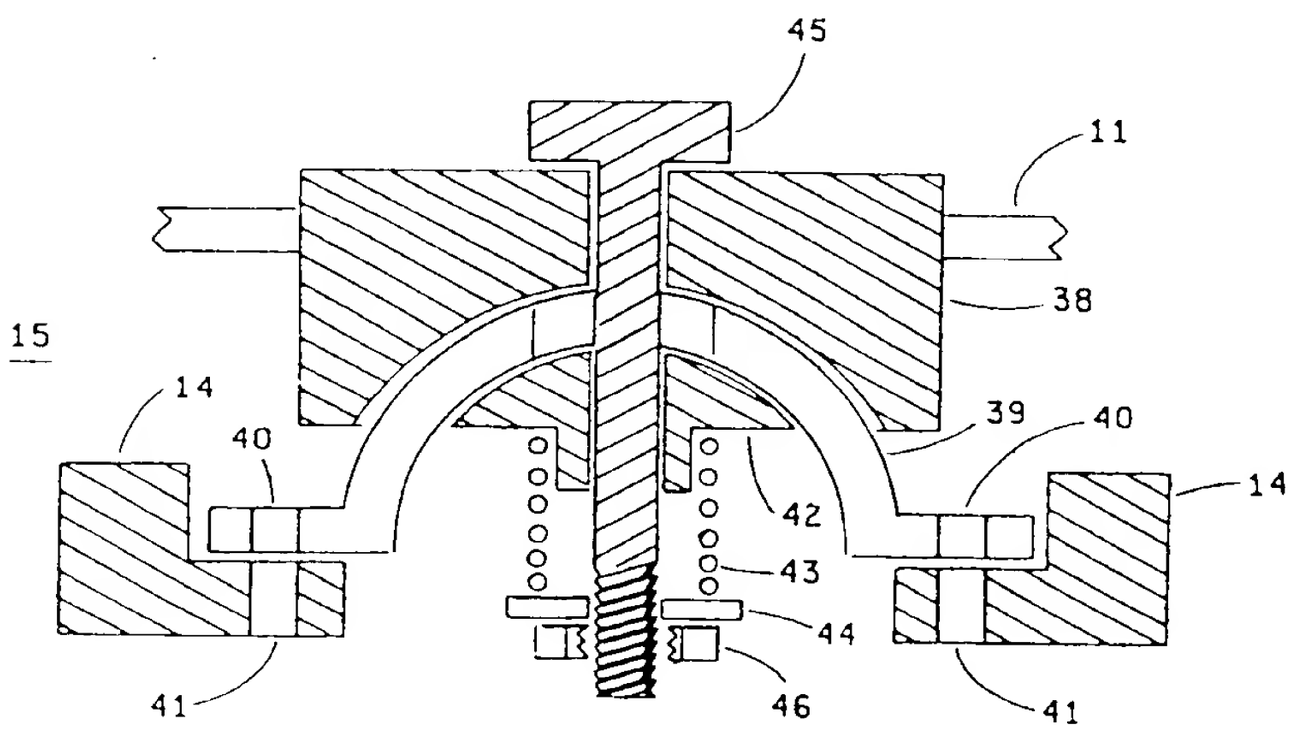

FIGURE 5

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 83 10 3525

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	US-A-2 233 300 (TRYTHALL) * Page 2, column 1, lines 5-30 *	1,5,8, 10,15, 19	F 16 M 13/00 F 21 V 21/28
Y	GB-A-2 024 926 (KJELLSTRAND) * Figure 2 *	1-4,12 -17,19 ,21-23	
A	FR-A- 663 741 (ANCIENS ETABLISSEMENTS BARBIER) * Page 1, lines 21-26 *	1,10, 11,15, 19,20	
A	US-A-2 220 214 (CLOUTIER) * Page 1, lines 40-49 *	7,18	
A	FR-A- 974 634 (MALOJA) * Page 1, column 2, lines 8-10 *	11,20	TECHNICAL FIELDS SEARCHED (Int. Cl ³) F 16 M F 21 V A 47 B H 04 N
A	US-A-3 358 957 (LINDENMUTH) * Figures 1-6 *	18	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-01-1984	FOUCRAY R.B.F.

CATEGORY OF CITED DOCUMENTS

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